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II.

On Segments made on Lines by Curves.

By Miss Christine Ladd, *Johns Hopkins University.*

The two theorems in regard to the segments made on a line by a fixed point and the intersections of the line with a curve, which are given in Salmon's *Higher Plane Curves*, Art. 123, are special cases of a more general theorem, which may be expressed in this way:

Through each of two fixed points, M, N, a variable line, μ, ν, is drawn. These lines intersect in the variable point X, and cut a curve of the n^{th} order in the points $m_1, m_2, \ldots m_n$ and $n_1, n_2, \ldots n_n$ respectively. Then the ratio

$$\frac{Mm_1 \,.\, Mm_2 \ldots\ldots}{Nn_1 \,.\, Nn_2 \ldots\ldots} : \frac{Xm_1 \,.\, Xm_2 \ldots\ldots}{Xn_1 \,.\, Xn_2 \ldots\ldots}$$

is constant.

For if A is the constant term in the equation of the curve, and if we write $F(\theta)$ for the coefficient of the term of highest degree in the equation transformed to polar coördinates, θ_μ for the angle which the line μ makes with the axis of x, &c., A_M for the value of the constant term when the point M is made the origin, &c., then we have

$$Mm_1 \,.\, Mm_2 \ldots\ldots = A_M : F(\theta_\mu)$$
$$Xn_1 \,.\, Xn_2 \ldots\ldots = A_X : F(\theta_\nu), \text{ \&c.}$$

Hence

$$\frac{Mm_1 \,.\, Mm_2 \ldots\ldots}{Nn_1 \,.\, Nn_2 \ldots\ldots} \text{ into } \frac{Xn_1 \,.\, Xn_2 \ldots\ldots}{Xm_1 \,.\, Xm_2 \ldots\ldots} \qquad (p)$$

$$= \frac{A_M}{F(\theta_\mu)} \cdot \frac{F(\theta_\nu)}{A_N} \text{ into } \frac{A_X}{F(\theta_\nu)} \cdot \frac{F(\theta_\mu)}{A_X} = A_M : A_N,$$

which is constant, since the coördinates of M and N are constant.

When the points M and N are at infinity the first factor in (p) becomes equal to unity, and the theorem shows that the ratio of the products of segments on two lines of fixed direction through a variable point X is constant. When the variable point X is at infinity the second factor in (p) becomes equal to unity and we see that the ratio of the products of segments on two parallel lines of variable direction through two fixed points is constant. It happens that the latter ratio has the same value as the compound ratio (p).